

Amendments to the Claims:

This listing of claims replaces all prior versions and listings of claims in the application:

Listing of Claims:

1. (Currently amended) A system, comprising:
a string of electrical energy storage units; and
a power converter selectively coupled to an individual storage unit of the string of storage units, the power converter being configured to transfer energy bidirectionally between the individual storage unit and the string of storage units, and to balance state of charge of the individual storage unit to a target state of charge, the state of charge of the individual storage unit being a fraction of a fully charged capacity determined from an impedance of the individual storage unit, a current of the individual storage unit, and the terminal voltage of the individual storage unit.
2. (Previously presented) The system of claim 1 wherein the power converter is configured to transfer energy at a controllable rate of transfer.
3. (Previously presented) The system of claim 1, wherein the power converter is configured to monitor voltage and current data of the individual storage unit resulting from a transfer of energy.
4. (Previously presented) The system of claim 1, wherein the power converter is configured to transfer units of energy between the individual storage unit and the string of storage units.
5. (Original) The system of claim 1, wherein the power converter comprises:
a primary inductor;
a first secondary inductor magnetically coupled to the primary inductor;
a first switch selectively coupling the individual storage unit to the primary inductor; and

the first secondary inductor coupling to an output capacitor;
the output capacitor coupled in parallel to the string of storage units.

6. (Previously presented) The system of claim 5, wherein:
the power converter is further configured to transfer energy from the individual storage unit to charge the primary inductor when the first switch is on, and to discharge energy into the first secondary inductor to charge the output capacitor when the first switch is off, the output capacitor discharging energy to the string of storage units.

7. (Previously presented) The system of claim 5, further comprising:
a first pulse generator configured to provide first enable signals to the first switch;
the first switch being configured to couple the individual storage unit to the primary inductor in response to the first enable signals, and to transfer energy from the individual storage unit to the string of storage units.

8. (Previously presented) The system of claim 7, further comprising:
a second pulse generator configured to provide second enable signals to the first pulse generator;
the first pulse generator being configured to provide first enable signals in response to the second enable signals, the second enable signals being capable of controlling a transfer of energy from the individual storage unit to the string of storage units at a controllable rate.

9. (Original) The system of claim 8, further comprising:
a second secondary inductor coupled to the individual storage unit, the second secondary inductor having a secondary voltage;
a voltage comparator;
a reference voltage and the secondary voltage being inputs of the voltage comparator.

10. (Previously presented) The system of claim 9, wherein the second pulse generator is configured to activate when the secondary voltage is greater than the reference voltage.

11. (Previously presented) The system of claim 9, wherein the second pulse generator is configured to deactivate when the secondary voltage reaches the reference voltage.

12. (Currently amended) The system of claim 1, further comprising:
a primary inductor;
a first secondary inductor magnetically coupled to the primary inductor;
a ~~second~~ switch selectively coupling the first secondary inductor to the string of storage units, and configured to transfer energy from the string of storage units to charge the first secondary inductor when the ~~second~~ switch is on, and to discharge energy into the primary inductor and charging the individual storage unit when the ~~second~~ switch is off.

13. (Currently amended) The system of claim 12, further comprising:
a first pulse generator configured to provide first enable signals to the ~~second~~ switch;
the ~~second~~ switch being configured to couple the string of storage units to the first secondary inductor in response to the first enable signals, and to transfer energy from the string of storage units to the individual storage unit.

14. (Previously presented) The system of claim 13, further comprising:
a second pulse generator configured to provide second enable signals to the first pulse generator;
the first pulse generator being configured to provide first enable signals in response to the second enable signals, the second enable signals being configured to control a transfer of energy from the string of storage units to the individual storage unit at a controllable rate.

15. (Original) The system of claim 14, further comprising:
a second secondary inductor coupled to the individual storage unit, the second secondary inductor having a secondary voltage;
a voltage comparator;
a reference voltage and the secondary voltage being inputs of the voltage comparator.

16. (Previously presented) The system of claim 15, wherein the second pulse generator is configured to activate when the secondary voltage is less than the reference voltage.

17. (Previously presented) The system of claim 15, wherein the second pulse generator is configured to deactivate when the secondary voltage reaches the reference voltage.

18. (Previously presented) The system of claim 1, wherein the power converter comprises:

an up-converter configured to transfer energy from the individual storage unit to the string of storage units; and

a down-converter configured to transfer energy from the string of storage units to the individual storage unit.

19. (Previously presented) The system of claim 18, wherein a common transformer is configured to serve as the up-converter and the down converter.

20. (Original) The system of claim 1, wherein each storage unit is a storage cell.

21. (Original) The system of claim 1, wherein each storage unit is a battery module having a string of storage units.

22. (Original) The system of claim 1, wherein a battery pack comprises a string of one or more storage units.

23. (Previously presented) A system, comprising:

a string of electrical energy storage units; and

a power converter selectively coupled to an individual storage unit of the string of storage units, the power converter being configured to transfer energy bidirectionally between the individual storage unit and the string of storage units, wherein the power converter comprises:

a primary inductor;

a first secondary inductor magnetically coupled to the primary inductor;

a first switch selectively coupling the individual storage unit to the primary inductor; and

the first secondary inductor coupling to an output capacitor;
the output capacitor coupled in parallel to the string of storage units;

a first pulse generator configured to provide first enable signals to the first switch; the first switch being configured to couple the individual storage unit to the primary inductor in response to the first enable signals, and to transfer energy from the individual storage unit to the string of storage units; and

a second pulse generator configured to provide second enable signals to the first pulse generator; the first pulse generator being configured to provide first enable signals in response to the second enable signals, the second enable signals being capable of controlling a transfer of energy from the individual storage unit to the string of storage units at a controllable rate.

24. (Previously presented) The system of claim 23, further comprising:

a second secondary inductor coupled to the individual storage unit, the second secondary inductor having a secondary voltage;

a voltage comparator;

a reference voltage and the secondary voltage being inputs of the voltage comparator.

25. (Previously presented) The system of claim 24, wherein the second pulse generator is configured to activate when the secondary voltage is greater than the reference voltage.

26. (Previously presented) The system of claim 24, wherein the second pulse generator is configured to deactivate when the secondary voltage reaches the reference voltage.

27. (Currently amended) A system, comprising:

a string of electrical energy storage units; and

a power converter selectively coupled to an individual storage unit of the string of storage units, the power converter being configured to transfer energy bidirectionally between the individual storage unit and the string of storage units;

a primary inductor;

a first secondary inductor magnetically coupled to the primary inductor;
a ~~second~~ switch selectively coupling the first secondary inductor to the string of storage units, and configured to transfer energy from the string of storage units to charge the first secondary inductor when the second switch is on, and to discharge energy into the primary inductor and charging the individual storage unit when the second switch is off;

a first pulse generator configured to provide first enable signals to the second switch;
the ~~second~~ switch being configured to couple the string of storage units to the first secondary inductor in response to the first enable signals, and to transfer energy from the string of storage units to the individual storage unit; and

a second pulse generator configured to provide second enable signals to the first pulse generator; the first pulse generator being configured to provide first enable signals in response to the second enable signals, the second enable signals being configured to control a transfer of energy from the string of storage units to the individual storage unit at a controllable rate.

28. (Previously presented) The system of claim 27, further comprising:
a second secondary inductor coupled to the individual storage unit, the second secondary inductor having a secondary voltage;
a voltage comparator;
a reference voltage and the secondary voltage being inputs of the voltage comparator.

29. (Previously presented) The system of claim 27, wherein the second pulse generator is configured to activate when the secondary voltage is less than the reference voltage.

30. (Previously presented) The system of claim 27, wherein the second pulse generator is configured to deactivate when the secondary voltage reaches the reference voltage.

31. (Currently amended) A system, comprising:
a string of electrical energy storage units having a first end and a second end; and
a buck-boost dc-dc power converter coupled simultaneously to a selected portion of the string of electrical energy storage units and to ~~end-points~~ the first and second ends of the string of electrical energy storage units, the power converter being configured to transfer energy

bidirectionally between the selected portion of the string of storage units and the end points of the string of storage units.

32. (Previously presented) The system of claim 31, wherein the power converter is configured to transfer energy at a controllable rate of transfer.

33. (Previously presented) The system of claim 31, wherein the power converter is configured to monitor voltage and current data of the selected portion of the string of storage units resulting from a transfer of energy.

34. (Previously presented) The system of claim 31, wherein the power converter is configured to transfer units of energy between the selected portion of the string of storage units and the end points of the string of storage units.

35. (Previously presented) The system of claim 31, wherein the power converter comprises:

- a primary inductor;
- a first secondary inductor magnetically coupled to the primary inductor;
- a first switch selectively coupling the selected portion of the string of storage units to the primary inductor; and
- the first secondary inductor coupling to an output capacitor;
- the output capacitor coupled in parallel to the string of storage units.

36. (Currently amended) The system of claim 31, further comprising:

- a primary inductor;
- a first secondary inductor magnetically coupled to the primary inductor;
- a ~~second~~ switch selectively coupling the first secondary inductor to the end points of the string of storage units, and configured to transfer energy from the string of storage units to charge the first secondary inductor when the ~~second~~ switch is on, and to discharge energy into the primary inductor and charging the selected portion of the string of individual storage units when the ~~second~~ switch is off.

37. (Previously presented) The system of claim 31, wherein the power converter comprises:

an up-converter configured to transfer energy from the selected portion of the string of storage units to the end points of the string of storage units; and

a down-converter configured to transfer energy from the string of storage units to the selected portion of the string of storage units.

38. (Previously presented) The system of claim 37, wherein a common transformer is configured to serve as the up-converter and the down converter.

39. (Previously presented) The system of claim 31, wherein each storage unit is a storage cell.

40. (Previously presented) The system of claim 31, wherein each storage unit is a battery module having a string of storage units.

41. (Previously presented) The system of claim 31, wherein a battery pack comprises a string of one or more storage units.